Wilderness Network Conservation in the Cantabrian Region of Northern Spain

BY FERNANDO ALLENDE, MANUEL FROCHOSO, RAQUEL GONZÁLEZ, and NIEVES LÓPEZ

Abstract: Natura 2000 is a pan-European network whose principal aim is to conserve the European spaces of greatest natural interest. Its effectiveness is analyzed in a specific sector in Spain, namely the Atlantic Region, through an exhaustive division and assessment by area. This article considers questions related to the impact on the spaces included within the network, providing specific examples associated with the fauna, flora, and the territorial agroecostructures. Alternatives and communication possibilities are suggested for those spaces excluded from the network, but which have a key role as nodes for interchange and connection of biodiversity.


Fernando Allende


Manuel Frochoso


Raquel González


Nieves López

Introduction

The Directive 79/409/EEC of 1979, related to wildfowl conservation, established for the first time in Europe the normative basis for conservation of wildlife and nature. From then on, the efforts to form a pan-European network of protected areas intensified, which has the aim of maintaining the integrity of ecosystems in the nine biogeographic regions of Europe (Schutyser and Condé 2009). The Council Directive 92/43/EEC of 21 May 1992 (ECD92) finally established the creation of Natura 2000 and its proposal of Sites of Community Importance (SCIs). A Site of Community Importance is a site that, in the biogeographical region or regions to which it belongs, contributes significantly to the maintenance of or restoration to a favorable conservation status of a natural habitat type in Annex I, or of a species in Annex II. It may also contribute significantly to the coherence of Natura 2000 referred to in Article 3, and/or contributes significantly to the maintenance of biological diversity within the biogeographic region or regions concerned. For animal species ranging over wide areas, Sites of Community Importance correspond to the places within the natural range of such species that present the physical or biological factors essential to their life and reproduction (Directive 92/43/EEC [art. 1 k]).

Natura 2000 was created to ensure the conservation of habitats and species of special interest in each European region. The biological and anthropogenic factors that have an influence in Natura 2000 management are analyzed. Analysis of the spatial distribution of these factors enables the evaluation of the degree of interconnection on a detailed scale, evaluating the strengths and weaknesses of the system not only in terms of the richness of the variables but also in terms of the management systems involved.

Objectives and Methods

In this article, an analysis has been carried out on a medium scale, selecting a sector in the Spanish Atlantic Region: the Cantabrian coast (Bay of Biscay) and mountains (see fig. 1). Initially, sectors that have a certain degree of homogeneity were defined. In the ecological approach, methodologies were

PEER REVIEWED

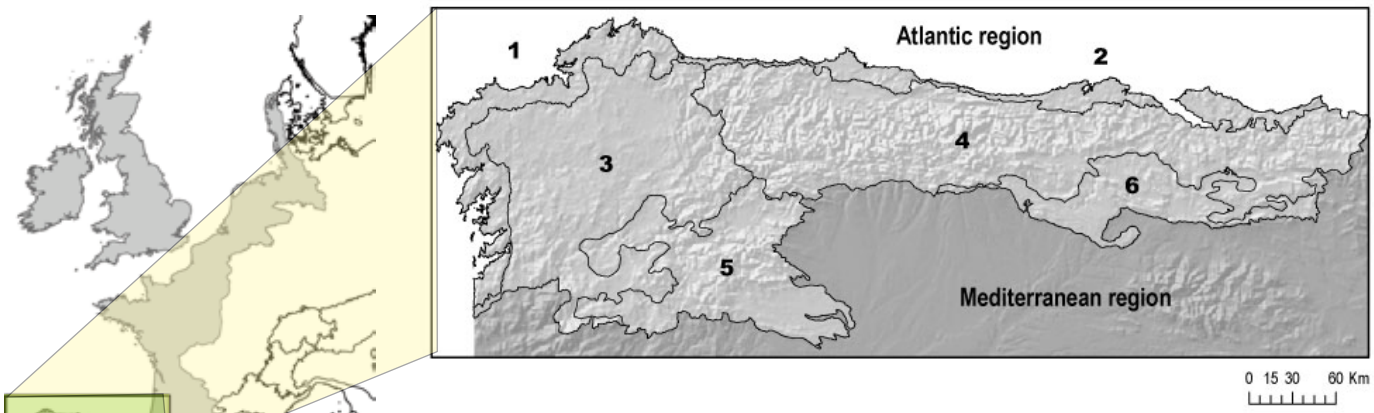

Figure 1 – Biogeographical regions of Europe (European Environment Agency, 2009) and Iberian Peninsula study area (the Atlantic Region is lightly shaded). Area of the work and division into sectors: (1) Northwest Atlantic Littoral; (2) Cantabrian (Bay of Biscay) Littoral; (3) Galicia-Leon Sierras, Hills and Plains; (4) Cantabrian Mountain System and the Western Pyrenees; (5) Galicia-Leon Sierras and Depressions; (6) Mountains of Palencia, Burgos, and Southern Alava. *Source: Authors of data of the EAE (Spanish Statistic Agency), 2009.*

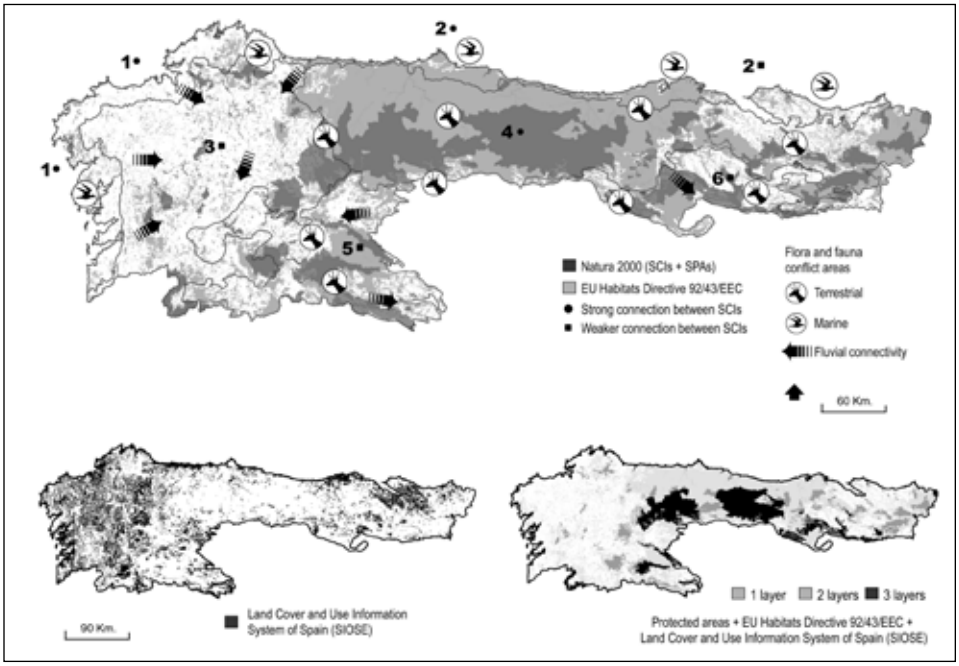

Figure 2 – Connectivity relationship and flora and fauna conflict areas in Spanish Atlantic regions. Sites of Community Importance (SCIs) and Special Protection Areas for Bird (SPAs) (A). Fragmentation surfaces – urban and intensive agriculture land use (B). Results of combining protection figures and traditional land uses areas (C).

used that pertain to the ecology of the landscape in terms of fragmentation (Smith et al. 2009; Ricketts 2001; Burel and Baudry 2003), connectivity (Murphy and Lovett-Doust 2004), and ecogeography (Foster 2002). For the territorial ones, our study is based on the geographical-type methodological contributions (Bertrand and Bertrand 2002; Martínez de Pisón, 1990).

The article takes advantage of basic information available in a digital format, which was compatible with a Geographical Information System (shapefile, coverage), providing delimitation based on ecogeographical criteria (Mata et al. 2004) and data available in the Biodiversity Database of The Ministry of the Environment (www.mma.es/portal/secciones/biodiversidad/). Using different merging and overlaying techniques, this information was simplified in six sectors (see fig. 1), which were validated topologically in ArcGIS. The choice of the variables followed the guidelines applied to Natura 2000 by Rodríguez et al. (2008), both for discrimination and in the search for "sensitive areas." GIS was used for multicriteria evaluation (see fig. 2) and the results allowed us to assess the degree of conservation and location of areas or points of interest that may act as connectors in accordance with the recommendations of Kettunen et al. (2007).

Results and Discussion

In each of the differentiated sectors, a general approximation is made along with a more specific one that refers to more localized examples. In the text it has been considered that the nuclear areas are those that pertain to the Natura 2000 network and those peripheral areas that, although included in ECD92, were not considered in the SCI proposal. In most cases, there is considerable coincidence between Natura 2000 and the protected spaces at regional or national level (regional park, natural park, and even national park such as the Picos de Europa) where these entities act as an effective management element.

This protection varies in intensity and quality, being especially effective in the mountainous areas in the central sector. However, there are problems of lack of protection in those sectors where there is no continuity among the protected spaces (western-end Galicia and eastern-end Cantabria and Basque country). This problematic situation is exacerbated in the potential corridors that, under good conditions, would provide excellent connectors among metapopulations of flora and fauna.

Figure 3 – Coastal cliffs in Tapia de Casariego (Asturias). Photo by Fernando Allende.

The Northwest Atlantic Littoral and Bay of Biscay Littoral

(See figure 2, areas 1 and 2)

The Northwest Atlantic and Bay of Biscay Littorals are the Atlantic Regions with the greatest connectivity in the Natura 2000 network. In the two zones there are extensive discontinuities that are only linked via fluvial corridors (see fig. 3). This provokes a degree of disconnection and extensive spaces without structure that are, however, well represented in ECD92.

The effects caused by extensive urbanization processes on the Galician coast (Costa da Morte, Costa da Vela, among others) are especially significant on the Cantabrian coast (Santander and Santona Bays) and the Basque coast. Their longitudinal character leads to the concentration of infrastructures as well as a dispersed but dense network of population centers. In the westernmost area, the hydrographic layout articulates the network to a large degree, although this is not an impediment to the existence of grave effects related to the general alteration of the hydrological system and bogland drainage. In the center and east, the mouths of the large rivers cause hiatus of maritime-territorial disconnection due to the existence of industrial and port concentrations (Eo, Navia, Nalón, Bidasoa) with important consequences for the resident wildfowl (Arcos et al. 2009) and migratory ichthyofauna, such as Atlantic salmon. In the whole sector, the pressure exerted by the cultivated forests of pine and blue gum eucalyptus should be highlighted as it disconnects patches of autochthonous forest and endemic metapopulations of amphibians such as the gold-striped salamander (*Chioglossa lusitanica*) (Pleguezuelos et al. 2002).

Galicia-Leon Sierras, Hills and Plains

(See figure 2, area 3)

The geomorphological complexity should be highlighted with outstanding elements in Spain such as minerotrophic peat bogs or fenland, morphologies derived from glacial activity, and extensively eroded or modeled surfaces over intrusive lithologies. Galicia-Leon is the sector with the least surface area included in the network and has large empty spaces among nuclear areas. The areas that occupy the greatest surface area are distributed in the mountain ranges and periphery massifs and in enclaves of the central Galician ridge. The fluvial corridors (Mandeo, head of the Miño, Eo, Masma, Ulla, Lérez, Alén, etc.) are the real connecting nodes.

The main threats are concentrated in the autochthonous forests, often surrounded by repopulated sectors where abusive logging takes place (Spanish Department for Conservation of Nature [DGCN] 2003). The elimination of the riverside and marshy vegetation in the mid-low fluvial stretches has generated accentuated eutrophication processes. It is frequent to find desiccation associated with processes of land consolidation that provoke the disappearance of some valuable wetlands in the interior of Galicia such as Antela (Martínez 2007) or the destruction of alkaline boggy complexes (García-Rodeja and Fraga 2009).

The Cantabrian Mountain System and the Western Pyrenees

(See figure 2, area 4)

These mountains have the principal feature of functioning as a transverse connector providing a link with the other large mountain system in the north of the peninsula, the Pyrenees.

The highest mountain ridge coincides with the divisor of the Duero watershed, and it is largely included in the Natura 2000 network. This area benefits from diverse regional and national protection mechanisms (see fig. 4). The fragmentation provoked by large roads is especially significant in the central mountains, which has negative impacts on the largest populations of brown bear (*Ursus arctos*) in the peninsula (McLellan et al. 2008). Discontinuities associated with opencast mining are common, especially in

Figure 4 – Northern limit of the Sierra de Urbasa (Navarra). Photo by Manuel Frochoso.

Figure 5 – The southern Alava Mountains (Sierra de Cantabria). Photo by Manuel Frochoso.

the central-southern sector of Asturias-Leon, threatening endemic species such as cappercaillie (*Tetrao urogallus cantabricus*) (Robles et al. 2006) and broom hare (*Lepus castroviejoi*) (Ballesteros and Palacios 2009). Where it borders on the Western Pyrenees, the progressive densification of the network of settlements and infrastructures (Oviedo, Torrelavega, Durango, etc.) accentuates the fragmentation.

Galicia-Leon Sierras and Depressions

(See figure 2, area 5)

Galicia-Leon is important because it provides a transversal corridor to the Cantabrian Mountain System and a link between the northern mountains and the southern foothills. Moreover, it is an ecotonal sector between the Atlantic biogeographical region and the Mediterranean. It has a good connection with the transversal mountains (Trevinca-San Mamede, Cabrera, Ancares), but it also has large discontinuities on the northern slopes of the Eixe-Cabrera and Teleno or between Ancares-Caurel and Ancares-Gistredo. In some zones the Natura 2000 network is exclusively supported on fluvial corridors (Támega, Tera, Sil). It is enormously threatened by mining, abandonment of the traditional land uses, and by wind farms, with an especially grave impact on Iberian endemic species such as the gray partridge (*Perdix perdix hispaniensis*) (Onrubia et. al. 2004).

Mountains of Palencia, Burgos, and Southern Alava

(See figure 2, area 6)

As in the preceding case, these mountains make up an ecotonal set in which there are corridors favoring linear biodiversity east–west (Cantabrian-Pyrenean Range) and south–north (Cantabrian/Pyrenean-Duero/Ebro) (see fig. 5). Its exo- and endokarstic nature should be highlighted, as well as its extensive and varied hanging synclines, whose platform landscape is under threat from the installation of large wind farms. It has some of the most interesting aquatic and riverine communities, with the greatest genetic purity, including white-clawed crayfish (*Austropotamobius pallipes*), brown trout (*Salmo trutta fario*), and European mink (*Mustela lutreola*), which are gravely threatened by the modifications in the fluvial media and the introduction of foreign species (Gil Sánchez and Alba Tercedor 2007; Blanco and González 2001; Lecis et al. 2008).

Analysis of the disconnections, the lack of consolidation, or good connectivity among areas included in Natura 2000 was done with comprehensive knowledge of the territory and its problems. Table 1 shows the most important threats for each ecogeographical sector. These summarize the threats included in the data sheets prepared before the designation of SCIs (www.marm.es/), records consulted in the catalog of IBAs from SEO Birdlife (Important Birdlife Areas, Spanish Ornithological Society, www.seo.org/ibas.cfm), and field data collection. They include the effects that have a significant surface representation, 5% or more of the affected ecogeographical sector .

Table 2 shows the overlap and existing levels of protection in each sector for different protection levels (European, bilateral, or regional). For each sector the overall percentage covered by the different types of protection was estimated. The objective is to analyze what extension and type of regulation the areas of the network have. A percentage analysis was performed of the values that had significance in relation to the total area of each sector. The percentages considered were the surface area included in the network, the surface area occupied by the SCIs and SPAs, those that include some type of management system, and finally, the surface area that coincides with

Table 1 – Summary of threats in the different sectors:
(1) Northwest Atlantic Littoral; (2) Cantabrian (Bay of Biscay) Littoral; (3) Galicia-Leon Sierras, Hills and Plains; (4) Cantabrian Mountain System and Western Pyrenees; (5) Galicia-Leon Sierras and Depressions; (6) Mountains of Palencia, Burgos, and southern Alava.

Threats	Sectors					
	1	2	3	4	5	6
Extensive littoral urbanization	X	X				
Dispersed urbanization	X	X				X
Concentration of infrastructures	X	X		X		X
General alteration of hydrological systems	X	X	X			X
Forestry repopulations	X	X	X			X
Land consolidation			X			
Desiccation and alteration of wetland ecosystems			X			
Mining				X	X	
Abandonment of traditional uses					X	
Wind generators					X	X

X indicates the threats that exist in each regional sector (1 to 6).

protected sites that are established by state or regional norms.

The percentage covered by Natura 2000 is relatively low, with extreme values in the Northwest Atlantic Littoral (7.3%) and the Cantabrian Littoral (7.8%). Of these, 9.2% and 33.6% have some legal mechanism for territorial planning mainly coinciding with spaces included in the regional norms (96.5%). On the other hand, the connection of the coastal nuclear areas is well established, constituting a nearly continuous protected area. Important discontinuities have been identified in the fluvial-estuarine and nearby land sites as well as among the fragments of autochthonous forest.

One of the areas with greatest weakness in connectivity relations is the Galicia-Leon Sierras, Hills and Plains, which are articulated by a fragile protection web established on periphery ranges and narrow fluvial corridors. Overall, 13.2% of the unit is included in the network, 12.6% has management plans, and 98.5% coincides with protected spaces. Therefore, the question arises: "Is this an extension of the protected land or just a consolidation of what already existed?" Despite the efforts, valuable bogland vegetation, forest, and marsh communities included in ECD92 are outside the protected areas.

The Galicia-Leon Sierras and Lowlands area constitutes 21.2%, but in contrast only 2.7% of it has a management plan and 46.5% coincides with protected mechanisms. In this case the desire for conservation is at loggerheads with the interests that paralyze the planning in traditional hunting areas that have species as singular as gray partridge. In this sector, the Natura 2000 network unintentionally consolidates the connection, thanks to extensive unpopulated sectors in plateaus and small sierras.

The central axis of the Cantabrian Range has the greatest surface area in this network. One-half of the area has management plans, but this area was already a protected zone (69.6%). The neighboring peripheral sierras in the southern sector do not have effective protection, and they are optimal sectors for the expansion of valuable species such as the gray partridge. In the central sector, and especially in the east, the problems of connection are accentuated as there are extensive discontinuities among the medium-height mountains and the limestone sierras of Cantabria and the Basque Country.

The mountains of Palencia, Burgos, and southern Alava have an extensive percentage included in the network (34.3%). Only 25.7% of the area has a management plan, and of this, 28.8% coincides with protected spaces. In this case, we could say that there is a positive balance, favored by human depopulation, given that wide interstitial spaces have been gained that are now unproductive and that are key to the movement of species.

Conclusions

It is important to know whether the ecotonal relations among high, medium, and low lands will ever be considered in the areas of longitudinal migration among ranges or whether the extensive sequential scrubland formations will be considered as connection nodes. As for the management of some species, the Natura 2000 network may lead to the

Table 2 – Significant category percentages by territorial sectors:
(1) Northwest Atlantic Littoral; (2) Cantabrian (Bay of Biscay) Littoral; (3) Galicia-Leon Sierras, Hills and Plains; (4) Cantabrian Mountain System and Western Pyrenees; (5) Galicia-Leon Sierras and Depressions; (6) Mountains of Palencia, Burgos, and southern Alava.

Significant categories	1	2	3	4	5	6
% covered by the Natura 2000 network with respect to the total surface area of the sector	7.3	7.8	13.2	21.2	39.0	**34.3**
% occupied by SCIs	7.2	6.7	13.2	20.3	**38.2**	32.1
% occupied by SPAs	1.8	3.8	4.0	8.2	25.1	**29.9**
% that have a territorial planning system in place (PORN, PRUG)	9.2	33.6	12.6	2.7	**48.7**	25.7
% coinciding with the Protected Spaces existing in the Natura 2000 network	96.5	62.7	**98.5**	46.5	69.6	28.8